

SYSTEM AND METHOD FOR CALCULATING A USER AFFINITY

RELATED APPLICATIONS

This application claims priority to U.S. Provisional Application No. _____
(Attorney Docket No. 23452-500-301), titled "Knowledge Server," filed January 14, 2002,
which is hereby incorporated by reference. This application is related to U.S. Patent Application
Serial No. 09/401,581, filed September 22, 1999, which is also hereby incorporated by reference.

This application is also related to commonly owned patent application Serial No.
09/192,047 titled "Method and System for Conveying Expertise Based on Document Usage,"
filed November 13, 1998, which is hereby incorporated by reference. This application is also
related to commonly owned patent application Serial No. 09/191,587 titled "Method and System
for Summarizing Topics of Documents Browsed by a User," filed November 13, 1998, which is
hereby incorporated by reference. This application is also related to commonly owned
application Serial No. 09/339,174 titled "Profile Inferencing Through Automated Access Control
List Analysis Heuristics," filed June 24, 1999, which is incorporated herein by reference.

FIELD OF THE INVENTION

The invention relates to a system and method for determining a user's affinity with a
particular topic by using a formula to calculate a person's affinity based on historical actions of
the user on particular documents and categorization of the documents.

BACKGROUND OF THE INVENTION

Many organizations have some form of employee directory and usually have made an
attempt to augment this directory with personal profile attributes such as memberships, position,

title or project affiliations. Many have attempted to expand each employee's profile by adding skills inventory, educational background or professional accomplishments. Many of these efforts have been successful, but most have not fulfilled their goal. The effort required to update and maintain such a profile and a subjective nature of self-description leads to inaccuracies or stale data.

Often, people who have relevant knowledge in a particular topic are not contacted because a method to search for persons with such knowledge has not been implemented. Most such people finder systems fail due to a lack of timely updates to an employee's profile. In addition, knowledgeable workers may not consider their experience to be valuable to others and may overlook this when manually completing profile forms. The result is that many manually built expertise locator systems are irrelevant or become outdated and eventually fail.

These and other drawbacks exist.

SUMMARY OF THE INVENTION

One object of the invention is to overcome these and other drawbacks of existing systems.

Another object of the invention is to provide a system and method for facilitating locating users with expertise in a particular topic.

Another object of the invention is to provide a system and method for facilitating locating users with expertise in a particular topic by assigning categories to objects associated with the users.

Another object of the invention is to provide a system and method for facilitating locating users with expertise in a particular topic by mapping between the categories and objects associated with the users.

Another object of the invention is to provide a system and method for facilitating locating users with expertise in a particular topic by maintaining a record actions performed on an object by the users.

Another object of the invention is to provide a system and method for facilitating locating users with expertise in a particular topic by calculating an affinity score for a user based on an object category and an actions record.

Another object of the invention is to provide a system and method for facilitating locating users with expertise in a particular topic by calculating an affinity based on a weighted sum of factors associated with an object including whether the user is an author or editor, if the user is responding to another object, if the user merely views the object, and if the object includes links to other objects.

Another object of the invention is to provide a system and method for facilitating locating users with expertise in a particular topic where the affinity score is calculated based on the weighted sum of factors over all time.

Another object of the invention is to provide a system and method for facilitating locating users with expertise in a particular topic where the affinity score decays over an inactive period of time.

Another object of the invention is to provide a system and method for facilitating locating users with expertise in a particular topic where the affinity score may be reset after any action is performed on the object.

These and other objects of the invention are achieved according to various embodiments of the invention. According to one embodiment, a system, method and processor readable medium comprising processor readable code embodied therein are provided that calculate a user

affinity score for at least one category. The system includes at least one categorized document.

The document may be categorized according to a topic provided in the document. The document may be mapped to one or more categories. A record of actions performed on the document by one or more users may be maintained. A weighted sum of a user's role and actions on the document in a category may be computed to determine an affinity score for that user's contribution to the category. The affinity score may be calculated as a sum over all time. The affinity score may be normalized and a population threshold may be applied such that a predetermined top percentage of users in each category may be designated as having an affinity for the category. The affinity may be based on a user's role in accessing the document, for example, whether the user is an author, editor, or reader of the document, whether the user is responding to another object of the same or different category, and whether the object includes links to other documents or objects of the same or different category.

If a user does not perform any actions on the document for a predetermined period of time, that user's affinity may decay. The rate at which user's affinity may decay may be at a constant rate or other rate determined by, for example, a system administrator. The user's affinity may be calculated as a sum over all time using a formula of:

$$A * V_a + T * V_t + L * V_l + E * V_e + R * V_r;$$

where A is an author field, V_a is an author value associated with the author field, T is a response to field, V_t is a response to value associated with the response to field, L is a links field, V_l is a links value associated with the links field, E is an editor's field, V_e is an editor's value associated with the editor's field, R is a reading field and V_r is a reading value associated with the reading field.

These and other objects, features and advantages of the invention will be readily apparent to those having ordinary skill in the pertinent art from the detailed description of the embodiments with reference to the appropriate figures below.

Brief Descriptions of the Drawings

Fig. 1 is a schematic block diagram of a method for determining a user affinity according to one embodiment of the invention.

Fig. 2 is a schematic block diagram of a method for calculating an affinity score for determining a user affinity according to one embodiment of the invention.

Fig. 3 is a schematic block diagram of a system for determining a user's affinity according to one embodiment of the invention.

Fig. 4 is a schematic diagram of a document that may be used to determine a user affinity according to one embodiment of the invention.

Detailed Description of Preferred Embodiments

A system, method, and processor readable medium having processor readable code embedded therein for determining a user affinity for a category is disclosed. The system may be used to facilitate locating users having an expertise or knowledge in a particular area. The system may automatically determine relationships between users and documents. The relationships may be based on a record of actions performed on documents by a user and a categorization of the documents.

Fig. 1 illustrates a method for determining a user affinity for a category according to one embodiment of the invention. A category may be assigned to, for example, a document, step 102. The category may be assigned, for example, when the document is created. The category

may be assigned, for example, based on repeated words in the document, images, or other criteria. Additionally, categories may be changed or other categories may be assigned to the document by, for example, a system administrator or other user, after the document's creation. The document may then be associated with a user, step 104. The document may be associated with the user when the user creates, edits, views or otherwise accesses the document. An actions record may be maintained, step 106. The actions record may identify actions that have been performed on a document by a user, time of action, duration of action, and other criteria. Based on actions performed on the document by a user and the category or categories assigned to the document, a user affinity may be determined, step 108. The user affinity may be a score calculated based on the user's actions regarding a particular document and the categories assigned to the document as described in further detail below with reference to Fig. 2.

After a user affinity has been determined, a determination may be made regarding whether the user has performed any additional actions on the document, step 110. If the user has performed additional actions on a document, the score used to identify the affinity may be reset, step 112. If, however, the user has not performed any actions on the document after a predetermined period of time, for example, one (1) week, the user affinity may decay. The user affinity may decay, for example, by a predetermined percentage after a predetermined period of time. For example, a user affinity for a particular category may have a score of one hundred (100). If the user does not perform any actions on the document, the score may be reduced by, for example, twenty (20) percent, after each week of non-activity. After the user affinity has been decayed, a determination may be made regarding whether the user has performed any actions on the document for up to, for example, another week. If the user does not perform any actions on the document, the user affinity may be decayed by, for example, another twenty (20)

percent. If the user performs an action on the document, however, the user affinity may be reset, step 112. Therefore, the score used to determine the user affinity may be reset to one hundred (100). The process of decaying may be repeated until a score of, for example, zero (0) is obtained or the user performs an action on the document. If a score of zero (0) is obtained, however, and the user performs an action on the document, the user affinity may be reset to, for example, one hundred (100).

A user or system administrator may be provided with an option of declining a user affinity. A determination may be made regarding whether the user or system administrator has declined the user affinity for a particular category, step 116. If the user or system administrator has declined the user affinity, the user affinity may be removed, step 118. If the user or system administrator has not declined user affinity, a determination may be made regarding whether the user has performed any actions on the document, step 110. According to one embodiment, a user or system administrator may designate whether other users may decline a particular user's affinity for a category.

A method for determining a user affinity is shown in Fig. 2. The user affinity may be determined by calculating an affinity score, step 202. The score may be based at least in part on meta data for a document. The meta data may include an author field, response to field, links field, editor's field, and reading field. The author field may identify the author of the document, the editor's field may identify any user that may have edited the document, and the reading field may identify any user that may have read or viewed the document. The response to field may identify whether the document is in response to another document. The links field may identify whether the document link to another document. Thus, for example, if a particular user is listed in the author, editor, and reading fields, a higher affinity score may be calculated. The affinity

score may also be based on actions performed on the document by the user. According to one embodiment of the invention, an infinity score may be calculated by assigning a value to the meta data of a document. For example, a value may be assigned to each of the author, response to, links, editor's, and reading fields. Each of the fields may be multiplied by the value associated with that field and then each product for all of the meta data may be added together compute the affinity score. For example, a formula for calculating an affinity score may be:

$$A * Va + T * Vt + L * Vl + E * Ve + R * Vr;$$

where A is the author field, Va is an author value associated with the author field, T is a response to field, Vt is a response to value associated with the response to field, L is a links field, Vl is a links value associated with the links field, E is an editor's field, Ve is an editor's value associated with the editor's field, R is a reading field and Vr is a reading value associated with the reading field. Each value associated with the fields may differ based on importance or other criteria. For example, the author value may be higher than the reading value. This may be because an author may have more knowledge in a particular category as opposed to a user who merely reads or views the document. According to one embodiment of the invention, a reading portion of the above formula may be calculated as:

$$\log_{10} (R + 0.0001) * Vr$$

This may assist in preventing popular or frequently visited documents from dominating the affinity score. Any method of weighting and assigning values may be used. The formula may also include other or additional action/value pairs such as, for example:

$$X * Vx + Y * Vy$$

where X and Y are other actions that may be identified as showing knowledge of a topic and Vx and Vy are values associated with the X and Y actions. Any amount of N actions may be used in the formula.

After calculating the affinity score, the affinity score may be normalized, step 204. Normalization may be performed according to any known manner. After normalizing the affinity score, a population threshold may be applied to the affinity score, step 206. The population threshold may identify all users that receive an affinity score of, for example, higher than zero (0), for a category. A predetermined percentage of the users within the population threshold may then be identified as having an affinity for the category, step 208. The affinity score may be cumulative for all time.

Fig. 3 is a block diagram of a system for determining a user affinity according to one embodiment of the invention. The system may include a category assigning module 302, document associating module 304, actions record maintaining module 306, affinity score calculating module 308, affinity score normalizing module 310, population thresholds applying module 312, percentage association module 314, affinity score maintaining module 316, affinity score the setting module 318, and affinity declining module 320. Category assigning module 302 may enable one or more categories to be assigned to a document. The categories may be, for example, assigned when the document is created. Alternatively, a system administrator and/or one or more users may be granted rights for assigning, changing, or deleting categories assigned to one or more documents.

Document associating module 304 may associate a document with one or more users. The association may be, for example, a user to category relationship. Document associating module 304 may identify categories associated with a user according to the categories assigned

to documents that the user has accessed. Actions record maintaining module 306 may be used to maintain a record of actions performed on a document by a user. For example, actions record maintaining module 306 may maintain a record of when a document is accessed by viewing, editing, creating, or other action performed by a particular user. The actions record may identify a date and time at which the document is accessed, an action performed on the document, and other information.

An affinity score may be calculated based on the actions record and categories assigned to documents by affinity score calculating module 308. Affinity score calculating module 308 may use meta data included with the document to calculate an affinity score. The meta data may include the following information: author, response to, links, editors, and reading. A value may be associated with each meta data. For example, an author value may be assigned to the author information, a response value may be assigned to the response to information, a links value may be assigned to the links information, an editor's value may be assigned to the editors information, and a reading value may be assigned to the reading information. The affinity score may be a sum over all time and may be calculated using a formula of:

$$A * Va + T * Vt + L * Vl + E * Ve + R * Vr;$$

where A is the author field, Va is the author value, T is a response to field, Vt is the response to value, L is a links field, Vl is the links value, E is an editor's field, Ve is the editor's value, R is a reading field and Vr is the reading value. According to one embodiment of the invention, a reading portion of the above formula may be calculated as:

$$\log_{10} (R + 0.0001) * Vr$$

This may assist in preventing popular or frequently visited documents from dominating the affinity score. The affinity score may then be normalized using affinity score normalizing

module 310. The affinity score may be normalized to any normalized value and according to any known normalizing method. After normalizing the affinity score, population threshold applying module 312 may identify users having a normalized affinity score of, for example, higher than zero (0). A predetermined percentage of users having a normalized affinity score higher than zero (0) may then be associated with the document using percentage association module 314. The users within this percentage may then be identified as having an affinity for a category assigned to the document.

If a user does not perform an action on a document for which the user has an affinity, the affinity score may be decayed using affinity score decaying module 316. The affinity score may be decayed at a constant or other rate and may be set by a system administrator or other user. For example, if a user has not performed any actions on a document for one (1) week, the affinity score may be decreased by twenty (20) percent. After each week of non-activity, the affinity score may be decreased by an additional twenty (20) percent. This may continue until the affinity score becomes zero (0), or a user performs an action on the document. If a user performs an action on the document, the affinity score may be reset by affinity score resetting module 318. Therefore, the affinity score may be set to the original affinity score provided to the user for the category.

According to one embodiment of the invention, the user, system administrator or other user may decline an affinity for a particular category. The users or system administrator may decline the affinity using affinity declining module 310. Users other than the user for which the affinity is associated, may be granted rights for declining affinities for categories to other users.

Fig. 4 illustrates a document 402 according to one embodiment of the invention.

Document 402 may include an author field 404, response to field 406, links field 408, editor's

field 410, and reading field 412. The authors field 404 may identify the author of the document.

Response to field 406 may identify whether the document was created in response to one or more other documents. Links field 408 may identify whether the document links to other documents or other documents link to document 402. Editors field 410 may identify users who have edited document 402. Reading field 412 may identify users that have read, or at least displayed, document 402.

According to one embodiment of the invention, a user may search for other users having an affinity for one or more categories. The search may be performed in any manner. The user may search for all users having an affinity for a particular category, users having an affinity score higher than a certain threshold, or other criteria.

Other embodiments and uses of the invention will be apparent to those skilled in the art in consideration of the specification and practice of the invention disclosed herein. The specification and examples should be considered exemplary only. For example, although the invention has been described in terms of a document, a document may be any electronic document that may be categorized, for example, electronic mail messages, graphic files or other type of electronic document. Additionally, although the invention has been described in terms of multiple modules, fewer or a greater number of modules may be used and modules may not be provided in the same location. The scope of the invention is only limited by the claims appended hereto.